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## GROWING HAY IN THE SOUTH FOR MARKET.

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### INTRODUCTION.

The South for many years purchased much of its commercial hay from northern and western growers. The quantity and value of hay brought yearly into each of the cotton-producing States has recently been approximately determined by the Bureau of Crop Estimates. These figures, with an estimate of the increase in acreage in each State necessary to produce the tonnage now imported, are shown in Table I.

NOTE.—This bulletin is designed to furnish information on the subject of hay growing to those farmers in the South who are contemplating changing from cotton growing to some other money crop.

TABLE I.—Quantity and value of hay shipped into the Cotton States yearly.

State.	Quantity.	Value.	Increase of acreage necessary to grow the hay now brought into the State. <sup>1</sup>	Increase of acreage over the crop of 1914 necessary to produce all the hay consumed.
	<i>Tons.</i>		<i>Acres.</i>	<i>Per cent.</i>
Virginia.....	200,000	\$2,960,000	160,000	24.6
North Carolina.....	100,000	1,520,000	80,000	25
South Carolina.....	90,000	1,413,000	72,000	34.3
Georgia.....	130,000	2,119,000	104,000	41.6
Florida.....	80,000	1,344,000	64,000	133.3
Alabama.....	90,000	1,206,000	72,000	32.7
Mississippi.....	70,000	826,000	56,000	26.6
Louisiana.....	70,000	840,000	56,000	28
Texas.....	250,000	2,550,000	200,000	44.4
Arkansas.....	100,000	1,110,000	80,000	25
Tennessee.....	125,000	1,738,000	100,000	12.5
Total.....	1,305,000	17,626,000	1,044,000	.....

<sup>1</sup> Computed from the average hay production of 1.25 tons per acre.

### DIFFICULTIES IN THE WAY OF PRODUCING MARKET HAY IN THE SOUTH.

There must be some serious obstacles in the way of producing hay when a great agricultural section imports more than one-fifth of all the hay it uses. These difficulties should be known and well understood by every farmer before he attempts to produce market hay in the South. One of the difficulties is in the matter of curing. The South has a heavy rainfall, and rain often comes at the time of harvesting the hay crop. Weather-stained hay, unless badly damaged, is quite satisfactory for feeding farm stock, but there is a strong prejudice against it on city markets.

Another drawback to hay production in the South is the lack of suitable hay plants that will thrive under the general climatic and soil conditions which prevail over most of that area. Nearly one-half of all the hay produced in the United States consists of timothy and red clover. Neither of these plants does well in the cotton belt. Alfalfa, which forms about one-eighth of all the hay produced in this country, has not been successfully grown in the South except in limited areas.

That it is practicable for the farmers of the South to produce all the hay needed on their farms is demonstrated knowledge. There is much difference, however, between producing hay for farm consumption and for the market. For home use, cowpeas, soy beans, Bermuda grass, corn, sorghum, and a number of other fodder plants answer very well, but these crops preserved as hay do not meet the general market requirements. A hay to compete with timothy, clover, or alfalfa on the city markets must be capable of being grown readily; it must be palatable; it must offer no serious obstacles in the matter of curing,

balancing, and shipping; and it must be free from the danger of becoming a weed pest if the seed gets into cultivated land. If it possesses all these characteristics it may become a competitor with the standard market hays. Unfortunately, many of the most valuable southern forage crops lack one or more of the desirable qualities.

#### SOILS SUITABLE FOR HAY PRODUCTION.

Bottom or alluvial lands, if sufficiently drained, are especially suitable for hay production and will probably give as great a profit when used for this purpose as for any other use to which they could be put, assuming, of course, that there is a good market for hay. There are also some extensive soil areas of limestone origin that will yield abundant hay crops. It is doubtful whether it is advisable to attempt to produce market hay on either the heavy clay uplands or the sandy soils of the South. Certainly it is inadvisable to plant a large acreage for market hay on such land without previous experience as to what crops may be expected both with and without fertilizers. On such lands oats, Italian rye-grass, Sudan grass, and the Arlington mixture (orchard grass, tall oat-grass, and alsike) are most likely to succeed. The production of hay will probably become more general over the cotton-growing section, but the change will necessarily be gradual unless Sudan grass or some other new grass simplifies the problems involved.

#### CURING HAY.

The curing of grass hay in favorable weather is a simple process. Curing is really a combination of three processes; i. e., drying, fermentation, and bleaching. The first two processes are necessary and desirable; the third is undesirable, but in field curing it can not be entirely avoided.

To secure the best quality of hay the drying process must not be too slow. To avoid uneven drying the processes of tedding and cocking are commonly employed.

*Tedding.*—Tedding is simply the turning or scattering of the cut grass after it is partially dry on top. It may be done by hand with a pitchfork or, preferably, by a horse-drawn machine called a tedder (fig. 1). When the crop is very heavy, the grass is sometimes tedded when in the swath, but usually not until after it has been raked into windrows.

*Cocking.*—Cocking consists of putting the partially cured hay into small piles. The object is twofold: (1) It reduces the surface exposed to moisture that may fall upon it, either as dew or rain, and (2) it evens up the drying, for the reason that the relatively dry leaves continue to draw water from the moister stems. Incidentally, cocking also reduces the amount of bleaching.

In unfavorable weather the labor of curing hay is much increased, as the cocks, until sufficiently dry, should be spread at each favorable opportunity and recocked again in the evening or when rain threatens. If hay that is not sufficiently dry be placed in the barn or stack it is likely to become moldy and dusty.

Cut hay should never be handled while wet with rain or dew. As the surface of the hay, if lying in the swath, is the part which was best cured before the rain, it is in the best position to dry promptly. If in the windrow, the stirring of the hay would bring the surface moisture in contact with the drier hay beneath, by which it would be readily absorbed.

*Sweating.*—The fermentation of hay takes place during the process of drying, and because of it the characteristic sweet odor is devel-

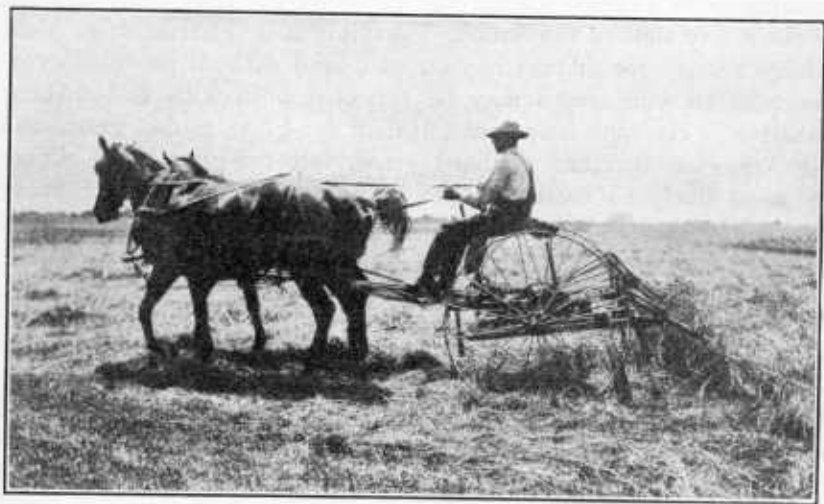


FIG. 1.—A hay tedder at work.

oped. The process is accompanied by the formation of heat, which is particularly noticeable in the later stages of curing in the cock, the stack, or the mow. This final stage of fermentation is called sweating. The process of sweating continues for a considerable period and hay should never be baled until the sweating has ceased. If for any reason curing be long protracted the hay becomes bleached or weather stained and loses most of its aroma.

*Curing legumes.*—Legumes, with the exception of lespedeza, are far more difficult to cure than grasses. This is due largely to their solid, more succulent stems, and to the fact that the leaves shed readily if the curing process is delayed, so that much of the leafage, the most nutritious part of the hay, is lost. Furthermore, legume hay absorbs rain or dew more readily, both in the windrow and in

the cock. Finally, legume hay is very apt to heat excessively in the sweating process if put in the stack or mow when not sufficiently cured. This heating is often sufficient to char the hay in the center and sometimes to cause fires. Legume hay should therefore never be put into a barn when half cured.

*Complete curing.*—Curing may be considered completed when the stems are apparently dry. At this stage a wisp of the hay breaks readily when it is tightly twisted in the hand and is dry enough to rattle if gently shaken.

### SPECIAL DEVICES FOR CURING HAY.

To hasten the drying of hay and to prevent the injury of half-cured hay by rain, several devices often used are helpful, but each necessitates additional labor.

*Hay caps.*—Various forms of hay caps to protect cocks from rain have been used. The simplest is a piece of canvas about 3 feet square with a weight at each corner.

*Perches.*—A perch is simply a pole or stake about 6 feet long, preferably with one or more cross arms 3 to 4 feet long. The stake is driven into the ground and the green or half-dried plants are hung upon it so as to make a tall, narrow cock. Perches are much used in curing peanuts and cowpeas.

*Pyramids.*—A pyramid consists of three or four legs, usually 6 to 8 feet long, pointed at the top and commonly sharpened below so they can be fastened firmly in the ground. Crosspieces joining the legs are also useful. A pyramid permits the building of rather large cocks with a hollow space in the middle, which helps greatly in drying the hay. The accompanying illustration (fig. 2) shows a form of pyramid for curing legumes devised at the Tennessee Agricultural Experiment Station.

The objection to all of these devices is the additional labor and cost involved. They are more useful for legumes than for grasses.

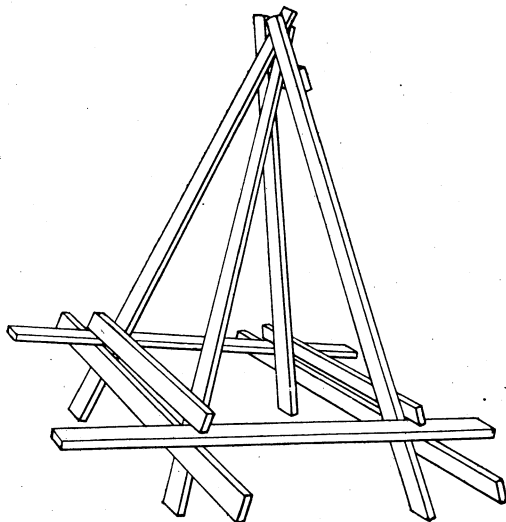


FIG. 2.—The Tennessee pyramid for curing legumes, especially soy beans and cowpeas. This consists of two A-shaped frames, so constructed that the top of one locks into the top of the other. Horizontal strips nailed at the base of these frames support loose crosspieces, to keep the vines off the ground. This may be constructed of poles or of 1 by 3 inch pieces 6 feet in length. The advantage of this curing frame over most others lies in the fact that it can be taken apart and stored in a small space.

## CROPS SUITABLE FOR MARKET HAY THAT MAY BE GROWN IN THE COTTON BELT.

There are a few grasses and legumes adapted to southern conditions that make good market hays. Lespedeza in the lower Mississippi Valley, Johnson grass over most of the cotton belt, Bermuda grass on the rich bottom lands, alfalfa in certain limited areas, and the Arlington mixture (orchard grass, tall oat-grass, and alsike) on the heavier uplands are fairly well known and valuable hay crops. To this list should be added Sudan grass, which is showing much promise as a hay grass for the South.

In growing hay for market the farmer must know the market requirements. These do not always correspond with the commonly accepted ideas in regard to feeding values. For instance, timothy has never been shown to possess a high nutritive value, either by chemical analyses or by feeding trials, but its palatability and freedom from ill effects on animals, especially horses, give it a market price above that of most other hays.

The legumes unquestionably have a higher feeding value than grass hays, but they are more difficult to cure, are liable to mold and become dusty, and are not especially desirable for horses, at least to feed alone. Legume hay, with the exception of alfalfa, seldom sells for as high a price on the market as first-class grass hay.

### JOHNSON GRASS.

Johnson grass is so well known in the South that little need be said concerning its culture. Where once established it is not easy to eradicate it, and on this account the plant has a bad reputation as a weed. Its ill repute as a weed has led to its good qualities as a hay plant being underestimated. Its reputation as a weed also reduces its market value for hay, as many feeders fear to use it because of the practical certainty of getting seed into the manure.

Whether a southern farmer should ever sow Johnson grass on land not already occupied by it is very doubtful. North of the Potomac and Ohio Rivers Johnson grass nearly always winterkills and so can not become troublesome as a weed. In the South, however, it is not easy to eradicate.

On land already covered by Johnson grass many southern farmers reap profit by cutting it for hay. Indeed, in some sections Johnson-grass hay is an important crop.

Johnson grass is best sown in March or early in April, using from 1 to 1½ bushels of seed per acre. It makes very little growth on light, sandy soils. Unless established meadows are plowed every year the yield of hay becomes much reduced and after the second year is very small. For this reason the best practice is to plow Johnson grass in

the fall and sow to oats or oats and hairy vetch. A crop of oats or oats and vetch hay can then be cut the following spring, followed by one or more cuttings of Johnson-grass hay later in the season. Johnson grass has proved a very satisfactory hay for city horses, many livery men considering it practically as good as timothy for this purpose. Its weedy habit and perhaps prejudice make its price on the market much lower than that of timothy.

#### BERMUDA GRASS.

Bermuda grass is well known throughout the cotton region. On most soils it is valuable primarily as summer pasturage. On alluvial and other rich soils, however, it grows tall enough to cut for hay and may be mowed two or three times in a season. On account of its dense growth and abundant leafiness, Bermuda grass yields very heavily in proportion to its height. Ordinarily it will average about 1 ton of hay per acre to a cutting, but double this yield has been obtained under exceptional conditions.

Tracy found at the Mississippi Agricultural Experiment Station that work mules did as well on Bermuda-grass hay as on timothy. The feeding value of the two hays for horses is probably about equal. Bermuda-grass hay, however, has no fixed status on the market, more of it being thus used in Louisiana than in any other State.

Bermuda grass is easily propagated by planting pieces of rootstocks or of the sod. The rootstocks may be chopped up in a cutting box and sown broadcast on well-prepared ground, covering with a disk or a common harrow. In some instances the sod itself is used. When an old field is plowed up, the sod can be torn into shreds and used in starting a new field by throwing pieces into the furrow after the plow and covering with a harrow. To save the loss of the land while the Bermuda grass is starting, it may be planted in the rows of any intertilled crop after the last cultivation. It does not thrive, however, if too densely shaded.

Seed of Bermuda grass is now grown in Arizona and this is of much better quality than that formerly on the market. The seed is very fine and rather high priced; therefore, the seed bed should be well prepared and firmed in order to avoid too deep sowing. The seed should be sown at the rate of 3 to 5 pounds per acre and covered with a roller. The best time to sow it in the extreme South is in February or early in March; farther north, in March or April. To scatter the seed more evenly it is well to mix it with meal or soil so as to make a larger bulk.

Lespedeza is the only summer crop that succeeds well in combination with Bermuda grass.



## LESPEDeza, OR JAPAN CLOVER.

Lespedeza is a Japanese annual legume now generally distributed through the South. Over most of its range it does not grow tall enough to cut for hay, but it is highly esteemed for the pasture it gives in summer and fall. In the bottom lands of the Mississippi Valley from Memphis south and on the richer upland soils of Louisiana and Mississippi lespedeza has for many years been an important hay crop. It is scarcely advisable to cut it for hay unless it is more than 7 or 8 inches high. On very rich soils it becomes 18 inches or, rarely, 24 inches high. The yield of hay varies from 1 to 3 or, rarely, 4 tons per acre.

Lespedeza usually continues to volunteer abundantly when once established, especially if used only for pasture. If cut for hay it is better to sow the seed than to rely entirely on volunteer crops. The usual rate of seeding is 15 pounds of hulled seed to the acre. The best practice is to sow the lespedeza seed in early spring, February or March, in fall-sown oats. The oats are harvested for grain, after which the lespedeza will produce a crop of hay, which is usually cut in October.

Lespedeza hay is now much used in the regions where it is grown, both for cattle and for city horses. About 10 per cent of the commercial hay sold in New Orleans is lespedeza.

For detailed information on lespedeza culture, see Farmers' Bulletin 441, entitled "Lespedeza, or Japan Clover."

## COWPEAS.

Cowpeas make excellent hay, comparable in feeding value to alfalfa. The plant is, however, coarse and difficult to cure so as to make bright hay. Cowpea hay is much better suited for feeding to cows than for horses. Partly on this account and partly because of its coarseness and great unevenness in quality, cowpea hay has but little standing on the city markets. The same remark also applies to soy-bean hay.

For detailed information concerning these crops, see Farmers' Bulletins 318, entitled "Cowpeas," and 372, entitled "Soy Beans."

## OATS.

Oats that are nearly ripe are often harvested in the South and fed in the bundle to farm animals. In the West, oats are often cut in the early dough stage for hay, but such hay is not well known in the South. There seems to be no valid reason why large quantities of oat hay should not be grown in the South and thus diminish the importation of timothy hay. As winter oats succeed well everywhere in the cotton belt, the growing of this hay presents no new problem.

For detailed information on the culture of oats, see Farmers' Bulletin 436, entitled "Winter Oats for the South."

## ITALIAN RYE-GRASS.

Italian rye-grass has about the same adaptations as rye or winter oats. Culturally it must be considered an annual, but individual plants will live two years or more. Sown in the fall it will make one crop of excellent hay early in summer. In Europe it is much esteemed and more than any other grass makes the commercial hay of Europe. Its growth is vigorous and rapid, and it will yield on the average  $1\frac{1}{2}$  tons of hay per acre in a single cutting, which is all that will ordinarily be obtained in the South, as it languishes in hot weather. The hay is of the highest quality for horses, and when well known should command the same price as timothy. This hay is already grown to a considerable extent in the South Atlantic States.

Italian rye-grass prefers sandy or sandy-loam soils, but thrives well on clay loams. Following it a crop of cowpeas can be grown the same season.

Seed of the Italian rye-grass may be obtained of the larger houses handling imported seed. Although most of the seed used in this country at the present time is produced in Europe, the price is reasonable, ranging from 6 to 12 cents per pound. A bushel of the seed weighs about 24 pounds, and from 20 to 30 pounds are required to sow an acre. This grass is almost invariably sown without a nurse crop.

The ground should be prepared for seeding by a deep plowing and then leveled by a thorough use of a disk or smoothing harrow. The continued use of the spike-tooth harrow until the ground is well settled is advisable. No other one thing is the cause of so many failures in seeding grasses as a loose seed bed. When the soil is thoroughly firmed, the seed may be sown broadcast and harrowed in or seeded with a grain drill. It should be covered to a depth of half an inch to 2 inches, depending on the nature of the soil. In a heavy clay soil the covering should be extremely light, while in a loose sandy soil so much care need not be exercised.

## ARLINGTON MIXTURE OF ORCHARD GRASS, TALL OAT-GRASS, AND ALSIKE.

The Arlington mixture consists of 10 pounds of orchard grass, 20 pounds of tall oat-grass, and 4 pounds of alsike for every acre. On the red upland soils of the South this is the only combination of northern grasses which can be recommended for a perennial meadow. It will produce satisfactory crops on soils where timothy and red clover are wholly unsatisfactory. At Arlington Farm, Va., this hay proved satisfactory in every way for horses and when well known should command a good price in the city markets.

Prejudice exists against orchard grass because it is rather coarse and against tall oat-grass because of its supposed unpalatability. Both of these objections are apparently not founded on any real basis. A more serious objection is the rather high cost of seeding per acre,

but where this mixture will make a good perennial meadow this point is of little consequence.

The seed should be sown in early fall or in early spring, preferably the former. Late fall seedings are inadvisable, as very young orchard grass frequently winterkills.

#### ALFALFA.

Alfalfa hay is one of the most nutritious and palatable of feeds for all classes of farm animals. In chemical composition it resembles clover, cowpeas, and allied legumes in having a high protein content, but it slightly outranks any of these that are now under cultivation in both total and digestible protein. Under favorable conditions several cuttings are procured in a season, thus making the total tonnage per acre somewhat greater than that produced by other legumes.

As regards soil requirements alfalfa is a most exacting plant, and, while it may be made to grow under a wide range of soil conditions, it is only in favorable locations that its production on a commercial basis becomes profitable. In general, the limestone soils are especially well suited to alfalfa. This is particularly true of the "black lands" of Alabama, Mississippi, and Texas. Certain of the well-drained river bottoms, particularly those that contain a considerable admixture of material from limestone regions, also produce profitable yields of alfalfa. On some of the Piedmont soils, such, for instance, as the Cecil clay loam in the vicinity of Rock Hill, S. C., alfalfa is being grown at a profit. As a whole, however, the Piedmont soils can not be recommended for the production of alfalfa as a market hay, on account of the uncertainty and expense encountered in establishing and maintaining a stand in that region. This statement also applies with equal or somewhat greater force to most of the Coastal Plain soils.

One of the chief drawbacks to the production of alfalfa for hay is the difficulty encountered in curing. The market demands a pea-green hay, and this color is often difficult to secure on account of the heavy precipitation in the spring and early summer months. The first and sometimes the second cutting comes when rainy days are likely to be frequent, and a great deal of care is necessary in saving these first cuttings in good condition.

As much of the hay grown in this region is liable to be more or less discolored in the process of curing, it can not compete successfully with the brighter colored hay from the Western States. Under these conditions, the practice of growing the crop in connection with dairying or hog raising is highly advisable, making the sale of the surplus hay a secondary consideration. That portion of the crop which is sufficiently discolored to injure its sale should be fed on the farm, as its feeding value may be only slightly less than that of the brighter

colored hay. Only the brightest colored portion of the crop should be put on the market.

Alfalfa hay when well cured always finds a ready market but ordinarily does not command quite as high a price as No. 1 timothy.

For detailed information on the culture of this crop, see Farmers' Bulletin 339, entitled "Alfalfa."

#### SUDAN GRASS.

Sudan grass is so recent an introduction that there is yet but a limited amount of information as to its value for a market-hay grass in the South. The present evidence indicates, however, that it is likely to be an important factor in the hay problem. While the grass is an annual, it may be cut two or three times in a season. The hay is comparatively coarse but so palatable that animals eat it very eagerly. The average yield per acre at Arlington Farm, Va., in three years has been 3.4 tons of hay from one cutting. At more southern experiment stations the following yields per acre have been secured: Jackson, Tenn., 2.6 tons; Agricultural College, Miss., 5.5 tons; Baton Rouge, La., 3.3 tons; Athens, Ga., 3.6 tons; Fayetteville, Ark., 1.1 tons; Chillicothe, Tex., 3.9 tons; Stillwater, Okla., 2.9 tons.

Sudan grass may be sown in the South as late as July 1 and still have ample time to grow a full crop of hay. Indeed, in some parts of the South late sowing may be desirable, as it will insure better average weather for curing. If, however, the seed is sown earlier, the second cutting will come in the early fall, and there is perhaps an even chance of good curing weather for the first cutting.

The seed may be sown broadcast or drilled, which requires about 20 pounds of seed per acre, or in cultivated rows  $3\frac{1}{2}$  feet wide, for which purpose 3 to 4 pounds is sufficient. When grown in rows the hay will be somewhat coarser.

For mixtures with cowpeas or soy beans Sudan grass is most excellent. It is stout enough to support the legumes, and the mixture is much more easily cured than either legume alone. The hay, too, is of higher feeding value than Sudan grass alone, but the mixture is better for cows and colts than for horses.

Owing to the remarkable demand for the seed of Sudan grass the price is very high. There is every reason to believe, however, that later the seed will be cheap, as the yield per acre is very large.

In the cotton belt a minute insect destroys the seed while forming. On this account commercial seed will be grown mainly in regions where this insect does not occur.

To what extent Sudan grass may prove to be a popular market hay remains to be seen, but the chances seem greatly in its favor.

More than all other plants Sudan grass promises to solve the problem of market hay over most of the South.

For detailed information concerning this grass, see Farmers' Bulletin 605, entitled "Sudan Grass as a Forage Crop."

#### EQUIPMENT FOR A SMALL HAY FARM.

The equipment for a small hay farm, 20 acres or more, besides the ordinary implements of tillage, should consist of a mower, a hayrake, a wagon with frames or racks, some pitchforks, and a hay tedder. (See figs. 1, 3, 4, and 5.)

The mower, rake, and tedder constitute the most expensive part of hay machinery, and the advisability of purchasing such implements



FIG. 3.—Mowing machines at work.

when they can not be rented depends directly upon the acreage grown and the care given them while not in use.

The cost per unit of production for mowers and rakes diminishes as the quantity of hay cut each year increases. This is well brought out by an investigation conducted by H. H. Mowry, of the Office of Farm Management. Records of over 600 mowing machines were obtained in a hay-growing section and grouped according to the size of the farms on which the mowers were used. One group included farms that had an average annual hay production of 13.8 acres, a second of 38.8 acres, and a third of 88.8 acres. The average length of life for a mower for these three groups was 16.1 years on the small farms, 14.6 years on those of medium size, and 11 years on the large farms. The size of the mowers, as measured by the width of the

cutter bar, increased with the size of the farms, being 4.9 feet, 5.4 feet, and 6.4 feet, respectively, for the three groups. The average original cost was \$40, \$42, and \$47.50. The total cost of these mowers, including the original cost, 6 per cent interest on the investment, and all repairs, made the average cost for each acre of hay cut 36 cents for the small, 17 cents for the medium, and 10 cents for the large farms. The hayrakes used on these three groups of farms varied in width from 8.6 feet for the smallest to 9.9 feet for the medium and 11.4 feet for the largest, the average original cost being \$22, \$24, and \$26, respectively.

The cost for each acre of hay raked, including the original cost of the rake and 6 per cent interest on the investment and repairs, was

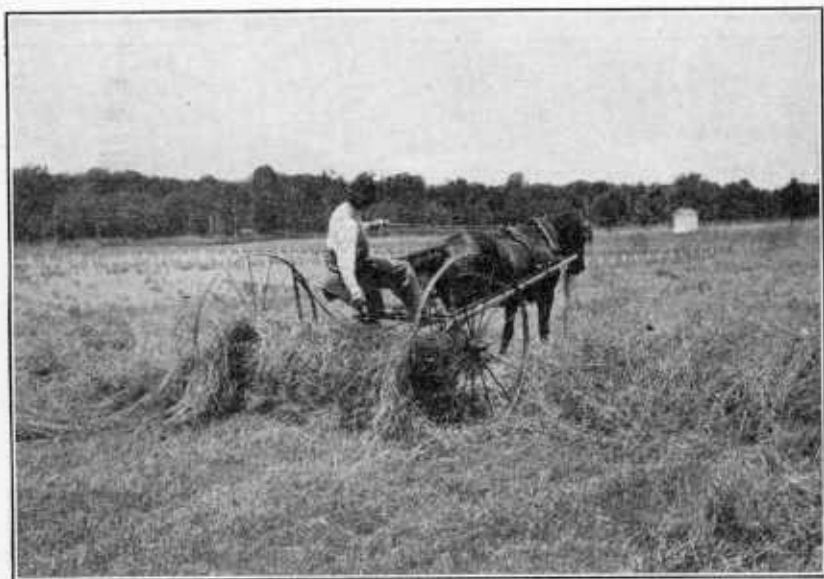


FIG. 4.—A hayrake at work.

15 cents on the small, 7 cents on the medium, and 4 cents on the large farms.

Estimating the yield of hay at  $1\frac{1}{2}$  tons per acre, the cost per ton for both mower and rake would be 34 cents for the small, 16 cents for the medium, and 8 cents for the large farms.

No data are available on the overhead cost of a tedder, but it seems reasonable to suppose that it is about twice as expensive as a rake.

#### HAY-HANDLING DEVICES.

The profitable production of hay depends a great deal on the substitution of horse labor for man labor. Much of the modern haying equipment, such as loaders and stackers, is too expensive for any but

very large hay farms. These should be purchased only after careful investigation of them in operation. There are, however, some cheap devices that every hay producer should have. Even the small hay farm should be equipped with a horse fork (fig. 6) and the necessary rope pulleys for its operation. Such an equipment, costing about \$15, is almost indispensable either for stacking hay or putting it into a barn.

*Stacking hay.*—One of the simplest stacking arrangements is a tripod support (fig. 7), which can easily be made by bolting together at the top three timbers 30 or more feet in length. An ordinary harpoon fork may be used, its rope operating through a pulley suspended from the top of the tripod. A single pole with a swinging arm supported by three stay wires (fig. 8) is easily built and often used.

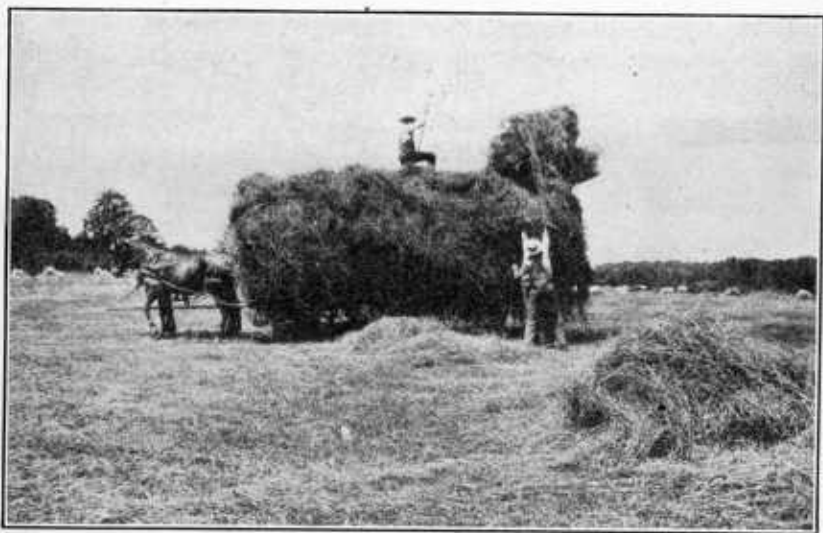


FIG. 5.—Loading hay. A good wagon fitted with a hay frame is essential to economical hay production except on large farms where hay stackers are used. Hay cocks with caps are shown in the background.

A little more complicated and expensive but more satisfactory arrangement is a wire cable supported in the air, over which a traveling carrier operates (fig. 9). If there are two large trees convenient for supporting the cable, the erection of this system is extremely simple. It may, however, be put up in an open field, supporting each end of the cable with two timbers crossed and bolted together at a point about a foot from their upper ends. The lower ends of these supports are spread out at the bottom to prevent the swaying of the cable. The cable must be drawn taut and the ends securely anchored to trees or to the ground. In the absence of anything else to which the cable may be fastened, anchor blocks buried 3 or 4 feet beneath the surface may be used. Larger stacks can be built with the cable than with the tripod arrangement.

A stack built with the use of a horse fork will usually keep the hay in better condition than if built by the old method, where the hay is pitched on the stack by hand. These stacks may be made taller and larger, thus reducing the proportion of surface exposed to the weather. The hay is dropped by the horse fork directly in the middle of the stack, and this guards against the stack tipping to one side on settling. It also insures keeping the center of the stack full and well compacted, which is the main factor in successful stacking. As the stack settles, the outside drops more than the center and thus sheds the rain better.

A stack is at best but a poor substitute for a barn or a hay shed in a humid climate and should be regarded as a makeshift (fig. 10). A hay shed need not be expensive. Any kind of shed, provided the roof does not leak, will do. Side boards extending down 5 or 6 feet from the eaves will prevent rain from being blown in on the hay after it has settled away from the roof. There will be very little damage on the exposed sides.

In building a barn or hay shed provision should be made for using a horse fork. The simple arrangement shown with the tripod stacking device (fig. 7) can be adjusted to work in almost any barn. It is better, however, to have a steel or wooden track suspended under the ridge, on which may be operated a hay carrier. This system, however, necessitates an open central framework of the barn or shed.

The cross timbers should be at least 12 feet below the track, in order to leave room for the loaded fork to pass.

#### SIZE OF STACK BOTTOMS.

Hay near the bottom of a stack will spoil unless there is some foundation to keep it off the ground. Stack bottoms are best made of two layers of poles or old rails. It is important to make the bottom of the right size. A stack 14 feet wide, 15 feet high, and 20 feet long, measured before it settles, will contain about 5 tons, every increase of

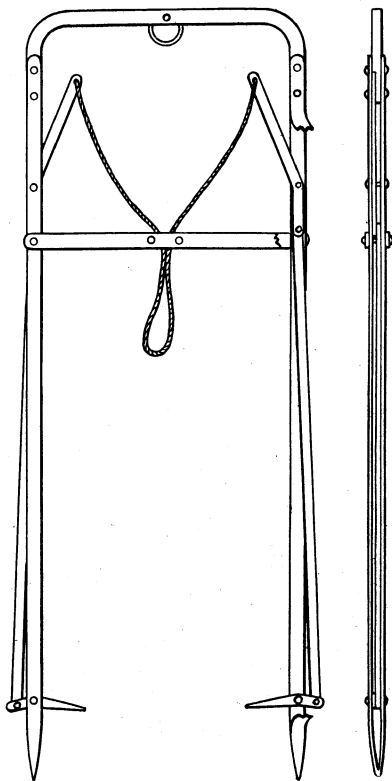


FIG. 6.—A double-harpoon hayfork, used for unloading hay. Figures 7 and 8 show this fork in use.



4 feet in length increasing the capacity of the stack by 1 ton. Stacks 16 feet wide, 17 feet high, and 20 feet long will contain about 7 tons, each increase of 4 feet in length increasing the capacity by  $1\frac{1}{4}$  tons. The smaller dimensions are common where the hay is pitched off the wagon by hand; the larger where stacking devices are used.

For detailed information in regard to the size and capacity of haystacks, see the paper in Circular 131 of the Bureau of Plant Industry entitled "Measuring Hay in Ricks or Stacks."

### HAY PRESSES.

There are several kinds of hay presses on the market. Among them are hand presses, box presses, 1-horse presses, 2-horse presses, and power presses.

Three kinds of bales are made: Box-pressed bales, round bales, and perpetually pressed bales. The perpetually pressed bale is the only kind in demand on the southern markets, and therefore only presses that make this sort of bale (the 1-horse, the 2-horse, and the power press) need be considered here. The first-mentioned press is not economical, on account of its small capacity.

The cost of a 2-horse

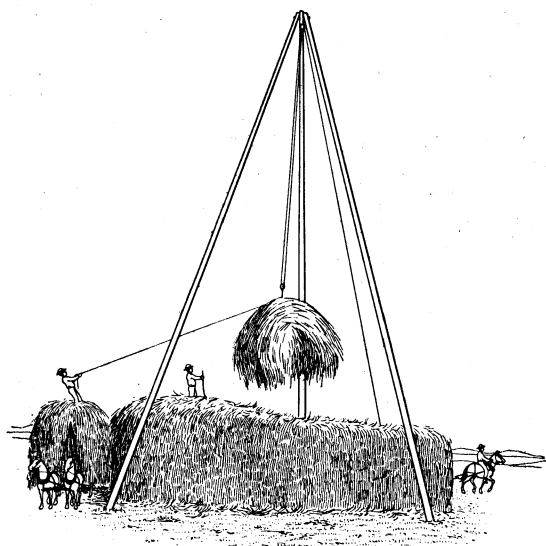


FIG. 7.—Stacking hay, showing a tripod with a horse fork in use.

press is \$150 to \$300 and of a large power press from \$500 upward.

One of the most convenient and efficient 2-horse presses now used is of the continuous-travel type that gives three impulses to the plunger to each revolution of the team and is so arranged that the hay is fed into an opening on the side or top of the press. As soon as a forkful of hay is placed in the press, the feed opening closes and the hay is carried down into the baling chamber. Hence, there is no necessity to force the hay down by means of a fork or the foot, as with some of the older types of presses.

One very efficient type of power press is provided with a self-feeding attachment composed of an endless apron conveyor and pickers that

distribute the hay evenly. The hay is then carried down to the baling chamber and forced into place by a mechanical arm.

For detailed information on baling hay, see Farmers' Bulletin 508, entitled "Market Hay."

#### DESIRABILITY OF OWNING A HAY PRESS.

The total tonnage to be baled in a single season should be the deciding factor when considering the purchase of a hay press. It is doubtful whether it will pay a grower to purchase even a 2-horse press if he has less than 50 tons of hay to be baled each year. When

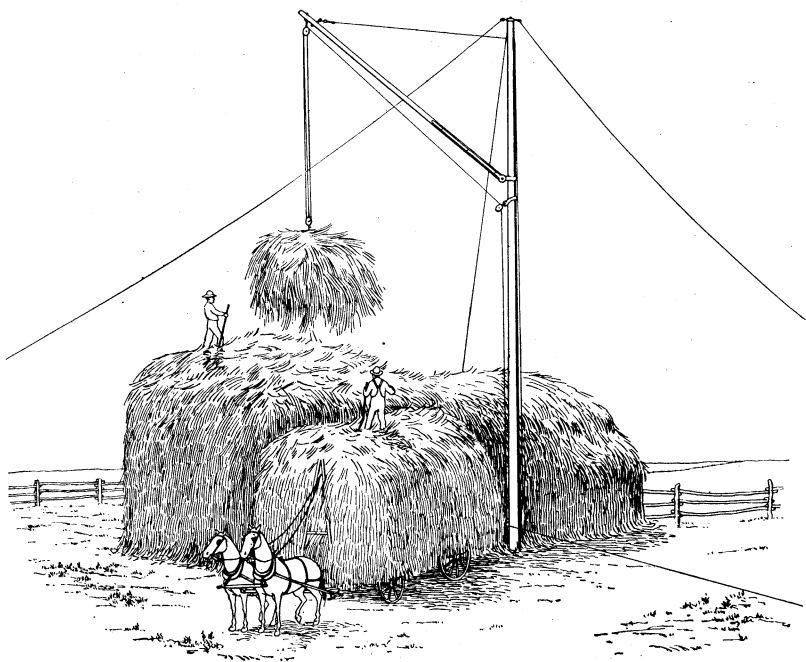


FIG. 8.—A single-pole stacker.

less than this quantity is grown it will be cheaper to hire the hay baled if it is possible to do so. Where there are several hay growers in the same community, each growing small quantities of hay, it is best to purchase a press in common, or else for one person to purchase it and make a business of baling hay, a frequent practice in most hay-growing sections.

A 2-horse press can be operated with four or five men and will bale 8 to 12 tons a day. A large power press will require about twice the crew of a 2-horse press, and consequently when a breakdown occurs there will be a relatively greater loss of time.

A power press will prove profitable only when a large acreage is grown by one individual or where there is considerable hay grown in the locality. Such a press should bale 20 to 30 tons a day. Unless there are at least 200 tons to be baled the 2-horse press is advised.

### BALING HAY.

Hay should be put up in neat, uniform, square-ended bales, properly wired, and with distinct folds or layers of approximately the same size and easily separable. Hay thus baled will always command a better price than slovenly baled hay, and especially on a crowded declining market.

Properly made bales possess evident advantages. If uniform in length more can be packed in a car. If square ended they are less liable to fall apart and thus cause loss to the shipper. If made up

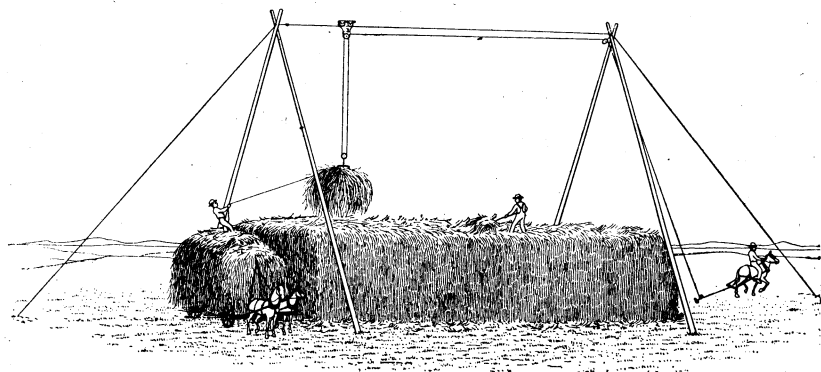


FIG. 9.—Stacking hay, showing one of the best stacking devices. This makes the construction of large ricks or stacks feasible.

of many folds or layers, a small quantity for feeding is conveniently and easily separated from the bale.

To make a good bale, care should be exercised to make each feed uniform and not to feed very large or very small forkfuls at random. Special attention should be given when starting or finishing a bale, in order to secure square ends. The division block should be dropped at the proper moment, thus insuring bales of uniform length.

Another very important point is to put only one kind or grade of hay into a bale. The custom of "sandwiching," or putting one or more forkfuls of spoiled or stained hay into the middle of the bale, usually results in a much greater financial loss than the mere value of the hay. It causes the shipper or receiver to be always on the lookout after he has once seen hay from a grower who tries to dispose of his spoiled hay by this method.

**BALING FROM THE FIELD.**

Hay is sometimes baled directly from the windrow or from the cocks. This practice is not a desirable one in humid regions, there being increased danger of loss from rains and inevitably a greater amount of bleaching. The most serious difficulty, however, is that hay from the field is often baled too soon. It may appear sufficiently cured, but on close examination it will be found that only the leaves are dry enough, while the stems are still sappy. After such hay is baled it will go through the process of sweating, and often on arrival

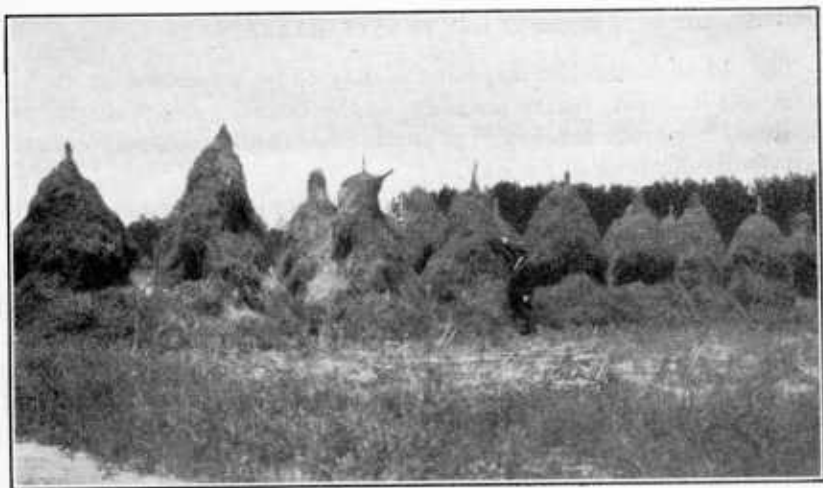


FIG. 10.—A group of small stacks, showing an enormous waste of hay. All of this hay should have been put in one or two stacks. A hay shed would soon pay for itself on this farm.

at the market will be found so hot and consequently damaged as to be classed as "no-grade" hay.

The evident advantage of baling from the field is to save the cost of stacking or of housing, but this advantage in reducing expense rarely compensates for the poorer quality of hay that is the usual result.

**BALING FROM THE STACK OR BARN.**

After hay has been stacked or housed it goes through the process of sweating, which requires five to eight weeks. This delay sometimes prevents a grower from taking immediate advantage of a good market, but on the other hand it insures a better quality of hay. After hay has gone through the sweat there is practically no danger of heating in the bale. Unless the circumstances are unusual, hay should not be baled before the process of sweating is complete.

**SELLING HAY IN LOCAL MARKETS.**

The most satisfactory method of marketing, especially by the beginner, is to sell on the local market. In so doing the producer and consumer come into personal contact and a definite understanding as to the quality or value of the hay may be reached. The question of grades, as they are known in the city market, is eliminated, and there is little need to discuss grades or to sell hay on grade, because the consumer is present and can inspect the hay and form his own opinion as to its value.

**SELLING HAY IN CITY MARKETS.**

The safest method of disposing of hay to be consumed in the city is to sell it direct, where possible, to the country shipper. By this method the grower is relieved of any further trouble or worry concerning the final selling of his hay.

In case the producer ships to the city market it is very advantageous to him to become acquainted thoroughly with each market in respect to the size and weight of bales preferred, the kinds of hay which are most popular, and the grade of hay demanded. This is necessary in order to avoid rejections when shipped on grade, and to prevent disputes, adjustments, possible lawsuits, and loss of money. The demands of the more important city markets are shown in Table II.

**SIZE AND WEIGHT OF BALES.**

Hay should always be baled in the sizes and weights most used, and especially in the size and weight most in demand in the particular market where it is to be sold.

The sizes of bales in general use are as follows:

Dimensions of small bales.....	{ 14 by 18 by 36 inches. 16 by 18 by 36 inches.
Dimensions of medium bales.....	{ 17 by 22 by 36 inches. 18 by 22 by 36 inches.
Dimensions of large bales.....	22 by 28 by 46 inches.

Bales are classified by weight as follows:

Small bales.....	60 to 100 pounds.
Medium bales.....	100 to 150 pounds.
Large bales.....	150 to 250 pounds.

**REQUIREMENTS OF SOUTHERN HAY MARKETS.**

In Table II are shown the kinds of hay usually sold and the sizes of bales most in demand in various southern cities as shown by investigations conducted in 1910 and 1911. In general, hay is received and sold in private warehouses. In New Orleans and Savannah, however, this business is transacted in a terminal warehouse.

TABLE II.—*The requirements of various southern markets with respect to the kind and character of hay offered for sale and the type of bales used.*

Name of city and kind of hay sold.	Type of bales demanded, in order of preference.	Common faults that affect the price of the hay received.
Atlanta, Ga.: Timothy, alfalfa, Bermuda grass, Johnson grass, millet, corn shucks.	Small (70 to 100 pounds), medium 3-wire (150 pounds).	
Augusta, Ga.: Timothy, Johnson grass, Bermuda grass, native mixed.	Small (80 to 100 pounds), large 5-wire (200 pounds).	Johnson grass very often cut too late.
Birmingham, Ala.: Timothy, alfalfa, Johnson grass, light timothy mixture.	Small (80 pounds).....	Local-grown alfalfa often improperly cured.
Charleston, S. C.: Timothy, timothy and grass mixture.	Small.....	Timothy often cut too late, has reddish color, and is mixed with briers and grasses.
Columbia, S. C.: Timothy, Bermuda grass, Johnson grass.	Small (16 by 17 inches), large (18 by 22 inches).	Timothy often cut too late, has red color, and contains trash and weeds.
Fort Worth, Tex.: Johnson grass, prairie hay, alfalfa, "coast" hay.	Small (60 to 80 pounds).....	First crop of Johnson grass often cut too late and improperly cured.
Galveston, Tex.: Texas prairie, Johnson grass, alfalfa, "coast" hay, timothy.	.....do.....	Cane and Johnson grass cut too late; prairie has reddish color caused by being cut too late.
Houston, Tex.: Johnson grass, prairie, alfalfa, "coast" hay.	.....do.....	Do.
Jackson, Miss.: Timothy, alfalfa, light clover mixture.	Small.....	Local-grown alfalfa off color and improperly cured.
Jacksonville, Fla.: Timothy, light clover mixture.	Medium (70 to 125 pounds), small (70 to 90 pounds).	Medium bales should have three wires; little demand for the lower grades.
Little Rock, Ark.: Prairie, alfalfa.....	Small (60 to 80 pounds).....	Red color in prairie hay is the most common fault found with hay in this market.
Macon, Ga.: Timothy, clover.....	Small (80 to 100 pounds), large 5-wire.	Local-grown hay often of poor color.
Memphis, Tenn.: Timothy, clover mixture, prairie, alfalfa.	Small (60 to 100 pounds).....	Sandwiched cars and bales often received; considerable hay off color; demand for timothy of better grades only.
Mobile, Ala.: Timothy, alfalfa.....	Small (80 to 100 pounds).....	
Montgomery, Ala.: Johnson grass, timothy, alfalfa, Bermuda grass.	.....do.....	Large quantities of low-grade timothy received in the past have caused this kind of hay to cease to be in very great demand.
New Orleans, La.: Timothy, prairie, alfalfa, clover mixture, clover, lespedeza.	Small, large.....	A large percentage of hay grades low, on account of being too mature and improperly cured.
Norfolk, Va.: Timothy, light clover mixture, clover.	Small, medium (100 to 125 pounds).	Timothy often cut too late, has reddish color, and is mixed with briers and grasses.
Pensacola, Fla.: Timothy, alfalfa.....	Small (80 pounds).....	More low-grade hay received than in demand.
Raleigh, N. C.: Timothy, native.....	Small (125 pounds), large....	Timothy often cut too late, has reddish color, and is mixed with briers and grasses.
Savannah, Ga.: Timothy, prairie, alfalfa.....	Small (90 pounds), large.....	Timothy often mixed with redtop, other grasses, and weeds.
Shreveport, La.: Timothy, alfalfa, prairie, Bermuda grass.	Small (60 to 70 pounds), 14 by 18 inches.	Local-grown alfalfa off color and improperly cured.
Tampa, Fla.: Timothy, prairie, clover.....	Small (90 to 100 pounds), medium (120 to 150 pounds).	Medium bales should have three wires.
Wilmington, N. C.: Timothy, clover.....	Small (125 pounds), large....	Timothy often cut too late, has reddish color, and is mixed with briers and grasses.

More detailed information on the subject of market hay will be found in Farmers' Bulletin 508, previously cited.

All of the publications mentioned in this bulletin, except Circular 131 of the Bureau of Plant Industry, the edition of which is exhausted, will be sent free of charge on request to the Secretary of Agriculture, Washington, D. C.

#### SUMMARY.

(1) More than one-fifth of all the hay used in the South is shipped in from other parts of the country.

(2) Growing hay for market in the South is a profitable business where the soil conditions are favorable for production.

(3) The heavy clay uplands and the sandy soils along the coast are not well suited for market-hay production.

(4) The special equipment necessary for the successful production of market hay consists of a mower, rake, tedder, wagon with frame, horse fork, pitchforks, and a hay press.

(5) The maintenance charge for hay-making equipment is so high that it is doubtful whether a farmer is justified in going into the business and incurring the expense unless he has 20 acres or more of hay to cut each year.

(6) Unless a farmer has 50 tons or more of hay to bale each year, he had better hire the hay baled than purchase a press.

(7) Where several farmers in one community raise small quantities of hay they should purchase a press in common, or else one should buy the press and make a business of baling for the others.

(8) There is less loss from damaged hay in large stacks or ricks than in small ones, but a stack at its best is a makeshift in a humid climate. Every one going into the business of producing market hay in the South should have barns or hay sheds in which to store his crop.

(9) The most serious difficulties in the way of producing market hay in the South are (1) the lack of plants adapted to the soil and climate that will make a hay capable of competing with timothy, red clover, and alfalfa, and (2) the danger of rainy weather during the period of curing the crop.







